THE

COMMON SCHOOL JOURNAL.

VOL. VI. BOSTON, AUGUST 15, 1844. No. 16.

GEOGRAPHICAL ERROR.

In the fifth number of the fifth volume of the Journal, under the above caption, we commented, at some length, upon a paragraph, then going the round of the newspapers, and entitled "Water running up hill." Our object was to point out certain errors of fact and of principle contained in that paragraph; and that object we believe was accomplished. But, as if to teach us a lesson of charity, as well as to furnish our share of the proofs of human fallibility, it seems that while commenting upon the errors of others, we fell into an error ourselves. We have received a communication from a most respectable and scientific source, touching the article above referred to; and, although our correspondent seems to have misapprehended our meaning in two or three instances, (perhaps from our own want of precision or clearness,) yet he has treated the whole subject in so lucid and able a manner, that we take great pleasure in laying his article before the more scientific portion of our readers.

Our error, it seems, consisted in supposing that the attractive force of the earth, upon a body situated at the poles, would be *less* than at the equator, on account of the vast preponderance of matter accumulated at the latter place. But according to the authorities cited by our correspondent, the attraction is *greater* at the poles than at the equator, in the ratio of 591, to 590,—the greater quantity of matter *under* a body situated on the equatorial surface, being more than balanced by its distance from the centre of gravity. Of course, the same principle applies *in degree*, to all points of the earth's surface between the equator and the poles. So far as the equilibrium of the ocean or of rivers is concerned, it is obvious that, if the attracting force, *at* or *towards* the equator, is less, then the centrifugal force necessary to keep them in their places, must be greater; and hence, it would appear that we did not allow sufficient comparative energy to the centrifugal force, in the ratio of 1 to 590. As to the inequality in the spheroidal surface of the earth, and the amount of the difference in the length of the two radii from the earth's centre to the head-waters, and to the mouth of

the Mississippi, &c. &c., we believe there is no difference between our correspondent and ourselves.

We cannot leave this introduction without thanking our correspondent for the notice he has taken of this subject. If we regard with gratitude the man who relieves us of an unsightly wound, or cures us of a disabling and painful malady, we hold him to be vastly more entitled to our thanks who rectifies an intellectual error, or reclaims from a moral aberration.

After a few introductory paragraphs,—which are superseded by the above remarks,—our correspondent proceeds to present his views on the two points of attraction, and centrifugal force, with their combined effects, as follows:

1. *Attraction.* The law of it is, *that masses attract each other directly as the quantities of matter, and inversely as the squares of the distances.* The spheroidal figure of the earth, we both admit. From this fact many interesting and important consequences follow. Such as relate to our subject I shall notice. It is important to bear in mind, also, that, though we speak of the centre of attraction, and of the earth as attracting every object on its surface towards the centre, the attraction has not an actual existence *at* the centre, but that it is the resultant of the attractions of all the atoms which constitute the earth. If the earth were a perfect globe, and of uniform density, the centre of the earth and the centre of attraction would be coincident. In its actual spheroidal shape, the only points, where the attraction is directly towards the centre of the earth, are at the poles and the equator. The deviation is small, and for our present purpose, it will perhaps be sufficiently accurate to speak of it as being there.

In consequence of the spheroidal figure of the earth, the force of attraction varies by a uniform and well ascertained law, being greatest at the poles, and constantly decreasing till it reaches its minimum at the equator. The general reason of this consequence will be obvious on the bare inspection of a diagram to be given in the sequel. Newton, Maclaurin, Clairault, and many other eminent geometers, have calculated this complicated problem, and found that the force of attraction at the poles, so far as it depends on the *form* of the earth, exceeds that at the equator, in the ratio of 591 to 590.

It is difficult to illustrate this part of the subject, in popular language, in such a manner as to show all the modifying circumstances to be taken into the account. The following may perhaps present the most important conditions of the problem. Under all circumstances the *mass* of the earth, or quantity of matter, is the same. The other two most important circumstances are the distance and the direction of the several parts of the earth from the body attracted at the surface. Both of these vary with every change of latitude. Suppose the earth to be divided into a large number of small cubes. Place a body at the pole, and each of these little cubes would have a certain direction and a certain distance from that body, both of which must be taken into the account in measuring the resultant force.

The most important is *distance.* Place another body at the equator. That also would be attracted by every one of these little cubes, but both the distance and direction of them all from the body supposed to be at the equator, would differ from those in the former case. Every one of these cubes would attract both bodies towards itself, by a force inversely as the squares of the distances. If we could measure the distance of every one of these cubes from the pole and obtain the sum of the squares of all the distances, and then obtain the distance of the same cubes from a body placed at the equator, and the sum of the squares of these distances also, and make due allowance for other modifying circumstances, the sum of the squares of the distances measured from the equator would be to the sum of the squares of the distances measured from the pole as 591 to 590. That is, a body drawn towards the centre of attraction by a force of 591 pounds at the pole, would be drawn towards the same centre by a force of only 590 pounds at the equator.

2. Let us now consider the centrifugal force separately. At the poles it is nothing, but in going thence towards the equator it commences instantly, and constantly increases by a uniform law till it reaches its maximum at the equator, where it counteracts, and virtually destroys $\frac{1}{289}$th part of the earth's attraction. The centrifugal force always acts at right angles to the axis of rotation. Its amount is easily calculated after the radius and time of rotation are known.

Now experiments on gravitation have been made with the pendulum in all accessible latitudes of the earth, which have established the fact, that the force, which causes a pendulum to oscillate at the equator is $\frac{1}{194}$ less, than at the poles; that is, *gravitation* is $\frac{1}{194}$ less at the equator than at the poles. A pendulum which vibrates seconds at the equator must be made longer with every increase of latitude, in order that it may not vibrate more frequently than seconds, till at the poles a seconds pendulum reaches its greatest length. That is, gravitation is greatest at the poles.

It is especially worthy of notice, that the sum of the two fractions, $\frac{1}{590}$ and $\frac{1}{289}$,—the former expressing the effect of the spheroidal form of the earth, and the latter, that of the centrifugal force on the degree of attraction,—amount almost exactly to $\frac{1}{194}$, the result obtained experimentally with the pendulum. Herschel supposes they would precisely agree. if we knew the exact constitution of the earth.

Having stated the principal circumstances which modify the earth's attraction, I will now give your solution, which, with some abbreviations, runs thus. "The earth being an oblate spheroid, having the greatest quantity of matter, *and therefore the greatest attraction*, under the equator, and the table land in which the Mississippi rises being elevated far above the general spheroidal surface of the globe, that river, like all the other rivers of the world, exhibits the wonderful phenomenon of water running down hill all the way."

You add; "The whole truth is, that the waters of the Mississippi are constantly tending to the common centre of

attraction, but being prevented from approaching that centre, *in a direct line*, they approach it indirectly by moving forwards along the bed of the channel. They are constantly approaching the centre of gravity, that is, *they are constantly descending*."

How can this be, when it is incontestably proved, that the points of surface, where the earth exerts its strongest attractions, are the poles, and the line where it exerts its least attraction is the equator, and that there is a constant decrease of attraction from the poles to the equator? How can this be, when it is admitted that the mouth of this river is about three miles further from the centre of attraction than its source? How can it be, even admitting, as I have already done, the existence of table lands about its source? This elevation is small, compared with the whole elevation of the mouth of the river,—certainly not more than one tenth of it.

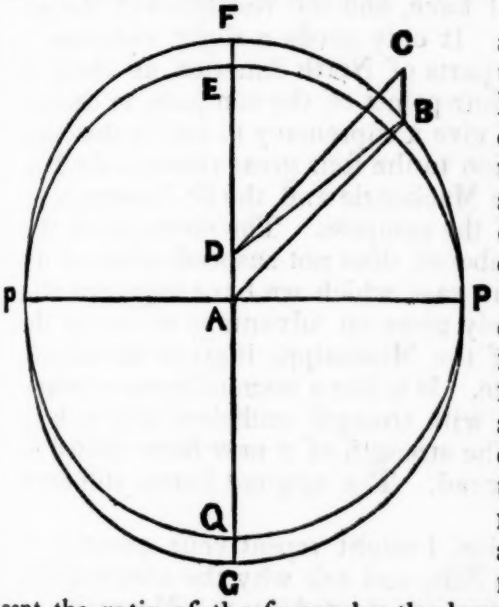
You say, "the centre of gravity of a body is that point about which all the parts are *in equilibrio*, or, in popular language, water, like every thing else, being attracted by matter, is most attracted, *other things being equal*, by the greatest quantity of matter."—Here let me ask, is not the quantity of matter in every case the same? is it not the whole mass of the earth? But you proceed, "the only philosophical idea we can have of 'up' or 'down' is 'from' or 'towards' the point of greatest attraction, that is, from or towards the centre of gravity."

Your error here is in assuming what I have put in italics, "*other things being equal.*" Other things are not equal. The quantity of matter is the only equal thing about it, that is, "this mighty globe itself." Everything else relating to the question is variable. If the attraction of matter were the only force acting upon the river, or if other forces were to cease their action, it would flow at once in the opposite direction, and that, too, in defiance of the table lands at its source. All the waters accumulated about the equator would flow towards the poles in *search* of an equilibrium. But water may be kept *in equilibrio*, between several forces, as well as by one; or rather, as well as by the resultant of the attractions of all the parts of the earth, which for convenience we call *one*.

You further remark, "were the spheroidal surface of the earth from the pole to the equator, a perfectly regular surface, the waters of the Mississippi would be as quiescent in their bed, as the waters of a canal. Notwithstanding the difference between the equatorial and polar diameter, the centrifugal force would not move one more than the other. Both would remain in their places by the simple force of attraction." My dear sir, "the simple force of attraction," has no more power to keep the waters of the Mississippi quiescent in this case, than Xerxes had to still the Hellespont with a whip. But bring in the aid of the centrifugal force to work with that of attraction, and they together would keep the river as quiet as sleep in the cradle. Once let go the centrifugal force, and you lose the charm that keeps it asleep. The "Father of waters," would wake up, and with all his "flat-bottoms" and "floating palaces" bid farewell to the Crescent City, and walk towards the

north pole, stepping lightly over those table lands, with a speed, —if you will only give him a straight and smooth channel,—surpassing the speed of the swiftest iron horse that ever careered over a railroad.

In the case supposed, of a regular spheroidal surface, from the pole to the equator, the Mississippi, like a canal, would be quiescent; but its waters would be balanced between two forces, the one acting more or less in opposition to the other. Two forces are constantly at work—gravitation, and the centrifugal force. The former is towards the centre of the earth, the latter at right angles to the axis of rotation. The action of both may be illustrated by a diagram. A simple inspection of the diagram, it seems to me, will make it plain that the strongest attraction must be under the poles, and the weakest under the equator.



Let P E P Q represent a perfect circle drawn through the poles. Let P F P G represent an ellipse drawn through the poles whose plane shall coincide with that of the circle, and whose curvature shall conform to the spheroidal figure of the earth, supposing it to be of uniform surface. Let A B represent the attraction of the earth, and B C the centrifugal force acting at right angles to P P, the axis of rotation.—It is not attempted to represent the ratio of the forces by the length of the lines A B and C B. The disparity is too great to be represented in a small diagram. Yet the nature of their action may be seen. Water, or anything else, at B, would be acted on by these two forces, one in the direction B A, the other in the direction B C. By a well known law of mechanics, the tendency of the body at B would be to move in the diagonal B D of the parallelogram A B C D. In the direction B D it cannot move, but does move as near to it as the interposing earth will permit, unless there is an exact balance of forces, between gravitation, represented by B A, centrifugal force, represented by B C, and the resistance of the ascent along the curve B F.

This balancing of forces is just what would keep the Father of waters asleep, if the spheroidal surface were regular from the pole to the equator. Take away the centrifugal force B C, and the water at B would manifestly flow toward P, that is from the equator towards the pole, that is, towards the centre of gravity.

The lifting force of B C constantly increases till it comes to act with greatest force at the equator. The central attraction B A, constantly decreases till it reaches its minimum at

the equator situated at F, at which place the two forces are in direct opposition to each other, and the one virtually overcomes and destroys $\frac{1}{289}$th part of the other.

With the same diagram, another illustration may be given. Suppose a cord to be fastened at the centre of the earth, and carried under a cylinder at B, and then turned up at right angles to the axis P P, as represented by B C. Lift on the cord at C, and carry it along keeping the cord above B at right angles to the axis. The tendency would be to roll the cylinder towards the equator, if more force were applied than just enough to keep it from rolling down towards P. Such is the tendency of the centrifugal force.

If the surface were perfectly regular, the waters of the Mississippi would not move, but remain perfectly balanced between gravitation, the centrifugal force, and the resistance of the ascent towards the equator. It only needs a slight elevation of table land in the central parts of North America, as about B, shelving off towards the four points of the compass, to destroy this balance of forces, and give a supremacy to one or the other of them, so as to give motion to the four great rivers,—the Mississippi, the Columbia, the Mackenzie and the St. Lawrence,—towards the four points of the compass. The elevation of this table land, let it be remembered, does not suspend either of the forces which existed in the case which we have supposed of a uniform surface, but merely gives an advantage to one or the other of them. In case of the Mississippi, it gives the advantage to the *contrifugal* force. It is like a team of horses attempting to draw a load up hill with strength sufficient only to keep it from running back. The strength of a new horse united to theirs, enables them to ascend. The original horses still draw as much as before.

On your own explanation, I might repeat your question respecting the course of the Nile, and ask why the accumulation of matter about the equator augmented by the Mountains of the Moon does not make it flow in the opposite direction. Or I might ask why the Green Mountains do not make trains of cars run up the Western Railroad.

You remark, that "the only philosophical idea of *up* and *down* is *from* or *towards* the point of greatest attraction," &c. as before quoted. Admitting these definitions, the waters of the Mississippi do run "up hill," that is, from the point of greatest attraction. Yet I do not contend for the propriety of this mode of stating the fact, since we commonly apply the terms *up hill* and *down hill* to more limited and irregular elevations.

I have made this communication much longer than I intended; but I need not tell you of the difficulty of divesting this subject, as far as practicable, of technical and scientific phraseology, and of presenting it in popular language without multiplying words. You must, yourself, have experienced the same difficulty, and will make allowance for me.

After all my care, I fear I may not have made myself in every part perfectly intelligible, but I submit these remarks as they are, to your candid consideration.

S. A.

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II

DRAWING.

LESSON FIRST,—TO THE SCHOLAR.

Look upon plate 1st,—on this cut stands the ground pillar of the art of drawing. If you come to it with your whole attention, with a tranquil mind, with no haste, and go on by regular steps, you may hope, you may indeed be sure, that you will go on with ease to all that follows. But above all things you must remember to do all that is to be done, in order fully to understand and execute these lessons, *with your whole attention.* With your whole attention, all that is to be done may be done easily, for it consists merely in placing one point after another, and then uniting them by straight lines. Placing the points is the chief thing, and the drawing of the lines completes the work.

Never draw a line before you have decided to your satisfaction that your points are right.

As soon as you have decided that your points are right, draw the line.

Never draw a coarse line. Make all your lines hair-lines. Remember this particularly. If you find that you have drawn a coarse line, rub it out and draw a fine one, because you can never draw well with coarse lines. You will be tempted to conceal a false, imperfect line, under these coarse, scratched marks.

Before you begin to draw, you must understand what the words *perpendicular* and *horizontal* mean.

A perpendicular line is a line drawn between two points. one of which stands over the other, thus |.

A horizontal line is a line whose points are opposite each other in this direction —.

All lines which are not perpendicular or horizontal are called oblique or slanting lines; thus ⁄ \, or such as are in any direction that is neither perpendicular nor horizontal.

[*Note by translator.*—This definition of perpendicular lines is sufficient for present purposes, but before the pupils have proceeded far it is well to show them that *every* straight line may have another drawn perpendicularly to it. This knowledge should be communicated when *angles* are explained, and these should always be explained by diagrams of the circle. To suppose that a line can be perpendicular only to a horizontal line is a partial view of the subject and leads to many errors and difficulties in drawing.]

Every one of the three above named lines may be bent or curved. But we have nothing to do yet with curved lines. Whenever you meet with these words in this book, therefore,—*perpendicular*, *horizontal*, and *oblique*,—remember that they are all straight lines.

Be very particular to place your paper straight before you, and never turn it or slant it; place your box of blocks* by your side,

* We think any ingenious person could prepare his own set of blocks; but those who wish to purchase, can procure boxes ready marked, at No. 13 West Street, Boston.

and sit in the proper position, that is, resting a little on the left hand, holding the right free to take the proper positions for drawing perpendicular, horizontal or oblique lines.

[*Note by translator.*—When you draw a horizontal line let your arm be perpendicular to the lower edge of your paper, and when you draw a line from one point to another, move the whole arm a little, in order to *keep* it perpendicular to the lower edge of your paper. It is very important to form this habit from the beginning, for if you are in the habit of moving only the fingers or stretching out the hand, when you come to draw long lines you will certainly make them slant downwards. You can easily prove this to yourself by attempting to draw a long line across your paper without moving your arm. You will find that the line will soon curve thus ⁀. The proper way is to draw about an inch at a time, then move the arm a little, drawing the length of another inch as you move. You will soon acquire the habit of slipping the arm easily along, drawing at the same time. You will perhaps understand me better if I express it thus. *Draw the line with your elbow as well as with your fingers.* Never allow your elbow to point toward your side, except when drawing an oblique line in this direction \. When you draw a horizontal line, let your arm be perpendicular to the right side of your paper, and draw by inches in the same way as before.

When you draw an oblique line, let your arm lie in a slanting direction according to the slant of the line, but never turn your paper.]

Take from the box of blocks the smallest one, the half cube, marked A, place it directly before you so that its front face be turned toward you. When you have done this, make the

Point *a*

two inches from the lower edge of your paper, and at the same distance from the left edge of it. When you have made this point, place the

Point *b*

perpendicularly over *a*, and as far from it as *b* is from *a* on the half cube block standing before you. If it is quite impossible, with all your attention and efforts, to place the point *b* at so great a distance perpendicularly over *a*, you may be allowed to put it a little nearer.

Before you go on, hold up your paper perpendicularly before you, and look at it attentively, to see whether the point *b* is precisely perpendicular over *a*, not a hair's breadth more towards the left or the right. When you are sure this is the case, draw a line from *b* to *a*, and be sure to draw it as fine as a hair, and at the same time perfectly distinct and straight. If it is as fine as a hair, distinct and perfectly straight, let it be a model for all your other lines. *A perpendicular line should be drawn from above downwards.* Next follows

Point *c*.

Look fixedly at the half cube standing before you, and ask

yourself this question; does the point *c* stand horizontally opposite the point *b*, and how far from *b*? Is it at the same distance as from *b* to *a*? You will soon answer yourself *yes*. When you have placed the point *c*, examine it as before to see if it is perfectly correct, that is, hold up your paper perpendicularly and see if the point *c* is as far from *b* as *b* is from *a*, and not a hair's breadth higher or lower. If the point *c* is right, draw the line from *b* to *c* as before, fine as a hair, distinct and straight. (*All horizontal lines must be drawn from left to right.*)

Point *d*.

At this point you must see whether *d* stands on the cube perpendicularly under *c* and horizontally opposite *b*. If you are certain of it, then place the point *d* on your paper, and draw two lines *c d* and *a d*, fine, distinct, and straight. But first prove to yourself that the point is right.

Point *e*.

This point is on the half cube horizontally opposite *c*, and as far from *c* as *b* is. Place the point and draw the line.

Point *f*.

At this point the question comes; how does *f* stand on the half cube? perhaps perpendicularly under *e*, and horizontally opposite *d*. When you have placed it thus, draw the two lines *e f* and *d f*, fine, distinct and straight.

The front face of the half cube A you have now finished. Examine it well to see if there is no fault in it. You have nothing to do in this lesson but to draw the front faces of all the other blocks. Take the cube B from your box and place it close by the side of the half cube A, so that the side marked with B alone may stand opposite to you.

Block B.—Point *g*.

This is the first point to be drawn from this block. Ask yourself how the point *g* stands in relation to some point on the block from which you have already drawn. It stands perpendicularly over *e* and as far from *e* as *f* is from *e*. Place the point thus, upon your paper, and draw the line *g e*.

Point *h*.

The point *h* stands horizontally opposite *g*, and as far from *g* as *f*, or as *e* from *b*. Now draw the line *g h*. (If the distance of *h* from *g* is too great, too difficult for you, place a point half way between, and draw half the line at a time.)

Point *i*

stands perpendicularly under *h*, and horizontally opposite *f*. Draw the two lines *h i* and *f i*. Examine your drawing by holding your paper up before you. If the surface of the block is not represented with perfect accuracy, rub it out and try again. Let every step be perfected before you proceed to another, and you will gain from it in the end a beauty and precision of drawing which you cannot now well imagine.

Block C.

Place it next to B, with the side facing you, which is marked C, and move A and B somewhat to the left, in order that C may stand exactly before you. The point *k* on this block stands perpendicularly over *h*, (block B,) and as far from *h* as *g* is from *e*, (block A.) Draw the line *k h*.

Point *l*

stands horizontally opposite *k*, and as far from *k* as *h* from *g*. Draw the line *k l*.

Point *m*

stands perpendicularly under *l*, and horizontally opposite *i*. Draw the lines *l m* and *i m*. (To aid yourself in the drawing of these lines, place a point half-way between, if necessary, and draw one-half at a time. I will not repeat this direction, but leave you to aid yourself thus when necessary. The sooner you can learn to draw without it, the better.)

Block D.

This is a block of two cubes. Slide A, B, and C a little to the left, place D exactly before you, so that you cannot see either of its ends, but only the front face. Let the side marked D face you.

Point *n*

stands perpendicularly over *l*, (block C,) and as far from *l* as *k* from *h*, (block B.) Draw the line *n l*.

Point 1

stands horizontally opposite *n*, and as far from *n* as *l* from *k*, (block C.) Draw the line *n* 1.

Point 5

stands perpendicularly under 1, and horizontally opposite *m*. Draw the lines 1 5, and *m* 5.

Block E.

Slide the other blocks to the left and place the block E of two cubes directly before you with the side marked E facing you.

Point 2

lies horizontally opposite 1, and as far from 1 as *n* is. Draw the line, 1 2.

Point 6

stands perpendicularly under 2, and horizontally opposite 5. Draw the lines 2 6, and 5 6.

Block F.

Place it exactly before you, having moved the other blocks a little to the left, with the side F facing you. Point *o* lies horizontally opposite 2, and as far from 2 as 1 is. Draw the line 2 0.

Point *p*

stands perpendicularly under *o*, and horizontally opposite 6. Draw the lines, *o p* and 6 *p*.

Block G.

Place this block as before directed for the others, moving those that already stand before you to the left. Point *q* stands as far from *o* (block F,) as a fourth part of the line *o p*, or horizontally opposite point *l*, on block C. Divide the line *o p*, into four equal parts and place *q* in the first point from *o*.

Point *r*

lies horizontally opposite *q*, and as far from *q* as *o* from 2, (blocks F and E.) Draw the line, *q r*.

Point *s*

stands perpendicularly under *r*, and horizontally opposite *p*. Draw the lines, *r s* and *p s*.

Block H.

Place this block directly before you, the side H facing you. Point *t* stands as far from *r* as the third part of the line *r s*, or horizontally opposite *h* on block B. Divide the line *r s* into three equal parts, and point *t* stands in the first point from *r*.

Point *u*

lies horizontally opposite *t* and as far from *t* as *r* from *q*. Draw the line *t u*.

Point *v*

stands perpendicularly under *u*, and horizontally opposite *s*. Draw *u v* and *s v*.

Block J.

Place J by the side of H, the side J facing you.

Point *w*

stands in the middle, between *u* and *v*, or horizontally opposite *e* on block A. Divide the line *u v*, exactly in halves and place *w* in the point of division.

Point *x*

lies horizontally opposite *w*, and as far from *w* as *u* from *t*, (block H.) Draw *w x*.

Point *z*

stands perpendicularly under *x*, and horizontally opposite *v*. Do all the points, *a*, *f*, *i*, *m*, 5, 6, *p*, *s*, *v*, and *z*, stand horizontally opposite each other, in one straight line? Draw *v z* and *x z*.

Block K.

Place this block upon block E. Let the block E now stand exactly opposite you, and let the side marked K face you. Observe, that the first division marked off upon this block is equal to the front face of block A; the second to block B or H; the third to blocks D, E, or F.

The left hand point of the lowest line upon K stands perpendicularly over point 1, (block D,) and as far from 1 as *n* from *l*, (block C.) Draw a line from this point to 1.

The left hand point of the second line upon block K stands perpendicularly over 1, as far from 1 as *l* from *m*, on block C. Draw a line downwards from this point.

The left hand point *f*, of the third line on block K, lies perpendicularly over the last point, and as far from it as 1 is from it. Draw from this point to the one next below it.

Point 3

stands perpendicularly over *f*, and as far from *f* as 1 from 5, on block D. Draw from this point down to *f*.

Point 4

lies horizontally opposite 3, and as far from 3 as 1 from 2, on block E, or as far from 3 as one half the line 3, *f*. Draw the line 3 4.

The right hand point of the first line from the top, stands perpendicularly under 4 and horizontally opposite *f*. Draw a line from 4 to this point.

The right hand point of the second line from the top lies perpendicularly under the last mentioned point, and horizontally opposite the second left hand point from the top. Draw a perpendicular and a horizontal line to this point.

The right hand point of the third line from the top lies perpendicularly under the last mentioned point, and horizontally opposite the third left hand point from the top. Draw a perpendicular and a horizontal line to this point.

In this lesson are 30 points. You have therefore taken 30 steps upon the ladder of the art of drawing. If they have been taken accurately you have a sure footing, and the ATTENTION by which you have been able to do it, is the instrument by which you can climb to all the heights of this art. If you have obeyed the directions conscientiously, you have no lines upon your paper but hair-lines, and perfectly perpendicular and horizontal lines. If you have not obeyed them conscientiously, throw away your drawing and make another. It may be a little tedious to you to draw the same lesson again, but remember that the better you draw this first lesson the better you will draw the others, and soon your skill in drawing straight and fine lines will be so great, that you will scarcely be obliged to think of those two things. They will flow freely and gracefully from the end of your pencil, and your whole attention may be given to the beauty of the forms you wish to represent upon paper. Let this be your precept. *Let every single step be executed perfectly.* If this is done, the whole will be perfect.

LESSON SECOND.—PLATE II.

Before drawing further, observe, that every time you have placed a point, hitherto, you have also connected it by a line with the point last made or with some other point. Do this in all cases. As I have fully urged your attention to this in the preceding lesson, I shall not repeat it in every instance in the following.

Place the several blocks, B, C, G, D, straight before you, and on a straight line, as in the plate.

Block Ba.

Place the point 7 upon your paper, perhaps two inches from the lower edge, and as far from the left hand side of it.

Point 8.

stands perpendicularly over 7. Place it as far from 7 as it stands from it on the block. Connect the two by a line. In every instance you need only ask yourself, does a point stand so, or so? When you have answered the question, make your point and draw your line.

Point *g*.

Does this point lie horizontally opposite 8 and as far from 8 as 7?

Point 9.

Does point 9 stand perpendicularly under *g* and horizontally opposite 7?

Block Ca.

Does point 10 lie horizontally opposite 9 and half as far from 9 as 7 from 9?

Point 11.

Does point 11 stand perpendicularly over 10? How high is 11 above 10 and how near to *g*?

You can find the answer to this question in the following manner. Take a thread of twine or silk. Hold it horizontally with outstretched arms as far as possible from one eye, the other being closed. You will perceive that the thread covers the points 8 and *g* (Block Ba) so that you cannot see them. This is the position required. Now hold the thread horizontally before the line 8 *g* so that it may be seen before the block Ca, and it will appear as if it cut through and divided the block Ca into two parts. Now compare the distance of the thread from point 11 which is above the thread to the distance from point 10 which lies under it. Does the thread cut the line 10, 11, one third of the way? If so, draw from *g* a horizontal guide-line out over 10 and place the point 11 as high above this horizontal line, (perpendicularly over 10,) as amounts to half the distance from 10, to the guide line.

Point *k*.

Does *k* lie opposite 11 horizontally, and as far from 11 as *g* (Block Ba) from 8?

Point 12.

Does 12 stand perpendicularly under *k* and horizontally opposite 10?

Block Da.

Inquire first where point 13 lies upon this block. Perhaps at equal distances from 11 and *k*.

Point 5.

Does 5 stand perpendicularly over 13, and yet as far from 13 as 11 from *k*, or as far as *g* from *q* (Block Ba?)

Point 1.

Does 1 lie horizontally opposite 5 and as far again from 5 as 13 is from 5?

Point 14.

Does 14 stand perpendicularly under 1 and horizontally opposite 13?

Block Ga.

Does *a* lie half as far from 14 as 1 does, or as far from 14 as *k* from 13 (Block Ca?)

Point *b*.

Does *b* stand perpendicularly under *a*, and horizontally opposite 12 (Block Ca?)

Point *q*.

Where does *q* lie? Perhaps horizontally opposite *a* and as far from 14 as *a*, or as far from *a* as *k* from 11 (Block Ca.)

Now place the three blocks L, F, E, as in the plate, and exactly facing you. But move the blocks already drawn a little to the left, so that Ga may stand exactly opposite to you.

Block L.

Does 15 on this block lie horizontally opposite *c* (Block Ga,) and half as far from *c* as *b*, or exactly as far as *q* from 14?

Point 16.

Point 16 stands perpendicularly over 15. How much higher does it stand than *q* on Block Ga? This you can ascertain by the help of your thread. Hold it horizontally before yon, so that it may cover the line *a q* (Block Ga) and see if the line 15 16 is cut in the middle. If so draw a guide line horizontally from *q* till it reaches perpendicularly over 15, and place 16 as high above that line as 15 stands below it. When you draw the line 15 16, draw first from 16 as far as the line horizontally drawn from *q*, and then from that point down to 15.

Point 17.

Does 17 lie opposite 16 horizontally, and as far from 16 as *q* from *a* (Block Ga?)

Point 18.

Does 18 stand perpendicularly under 17 and horizontally opposite 15?

When you draw the line 17 18, you may take a guide point half way between those two points, and in very long lines it is well to take two or three guide points. This direction will not be mentioned again, but do not forget it.

Block Fa.

Inquire whether 19 on Fa stands perpendicularly over *a* (Block Ga.) If you cannot tell with your unassisted eye, hold the thread perpendicularly before you so that it shall cover the

point 19, and see if it also covers *a*. If so, place 19 perpendicularly over *a*.

Point 20.

Does 20 stand over the third or fourth part of the line 16 17, (Block L?) Answer this for yourself, then draw a straight line from 19 through point 16 as far as perpendicularly over the third or fourth part of 16, 17.

Point *p*.

You can find this point by holding the thread perpendicularly over *p*,—that is, cover *p* with the thread, (holding it as in all other cases, with outstretched arms and as far as possible from one eye, the other being closed,) and see if the distance of the thread from 19 is greater or less or about the same as from 19 to 1. Having ascertained how it is, make a point where the thread cuts the line 5 1; draw from this point perpendicularly upwards, and on the perpendicular line mark the point *p* as far from 19 as 1 stands from 14.

Point *o*.

Does *o* stand as far from *p* as 20 from 19, and as far from 20 as *p* from 19?

Block Eb.

To find the height of the point 22, hold the thread horizontally before 22. Now see where it cuts the line 1 14, (Block Da.) If the distance of the thread from 14 is half as great as from 14 to *q*, or if the thread cuts the line 1 14, in the fourth, third, fifth or sixth part, mark the place with a point and draw from it horizontally to the line 17 18, (Block L.) Where this is cut, is the point 22.

Point 21.

lies horizontally opposite 18, and as far from 18 as 15 from 18.

Point *d*.

In order to determine point *d*, hold the thread horizontally before *d* and see where the line 22 17, is cut, whether in the middle, or a little above, or a little below the middle. Mark the place with a point and then draw from it horizontally to the right, and in this horizontal line place *d* as far from 22 as 17 stands from 16 (Block L.)

Point 23.

Does 23 lie as far from *d* as 21 from 22, and as far from 21 as *d* from 22?

Now let the gaps be filled up in the ground line, that is, draw a line between 9 10; 12 *b*; *c* 15; 18 21, &c.

This is the end of the Second Lesson. You have learnt by it the use of the thread. In future lessons, this thread will often come into use. In order to facilitate its use and to make it convenient, you can take two strips of whalebone. Upon one stretch a black horse hair, upon the other a white horse hair, so as to form two little bows. Attach these two bows together thus , and the advantage of the black and white horse hair, you will soon learn and rejoice in.

Erratum.—In the upper right hand corner of the Plate accompanying the last No., for "Two cubes" read "Two blocks of one cube."

FIFTEENTH ANNIVERSARY OF THE AMERICAN INSTITUTE OF INSTRUCTION.

THE annual meeting of the Institute, for the transaction of business *only*, will be held in Boston, at the Institute's room, 135 Washington St., on Tuesday, August 20th, at 9 o'clock, A. M.

Boston, August 15. SOLOMON ADAMS, *Sec.*

A meeting for the *public exercises* of the Institute will be held at Portland, Me., in the Exchange Hall, on the 30th and 31st of August, and on the 2d and 3d of September.

The Introductory Lecture will be delivered by Calvin E. Stowe, Professor in Lane Seminary, Ohio. Several lectures will be given daily by teachers and other distinguished friends of education. The time not occupied by the lectures, will be devoted to the discussion of topics relating to the great work of Instruction. The subjects of discussion proposed by the Committee of Arrangements are,—*Modes of Discipline; Home preparation for School; The importance of Visible Illustrations; What amount of vacation ought permanent Schools to allow? Are the daily sessions in school too long?*

In addition to the usual interest and benefit of the public exercises of the Institute, there are this year several incidental inducements to teachers at a distance, and others interested in education, to attend this meeting. The natural scenery of Portland and vicinity is surpassed by no place in New England. The conveyance from Boston is easy, expeditious, and cheap, either by railroad or steamboat. The sessions close, the day before the *Commencement at Bowdoin College*, so that gentlemen who wish can easily attend it. The meeting is at a time when most teachers have a vacation and opportunity to travel. They are invited to take this opportunity to visit the State, which has a territory as large as all the rest of New England, with more natural resources, in her fertile soil, her majestic forests, her rich mineral treasures, her noble rivers, her numerous bays and harbors, and her uncounted isles.

CORSETS.—A Philadelphia physician in a letter to a lady, on wearing corsets, has the following remarks:

"I anticipate the happy period when the fairest portion of the fair creation will step forward unincumbered with slabs of walnut and tiers of whalebone. The constitutions of our females are most excellent to withstand in any tolerable degree, the inflictions of the corset, eight hours every day. No other animal could survive it. Take the honest ox and enclose his sides with hoop poles, put an oak plank beneath him and gird the whole with a bed cord, and demand of him to labor. He would labor indeed, but it would be for breath."

[THE COMMON SCHOOL JOURNAL; published semi-monthly, by WILLIAM B. FOWLE AND N. CAPEN, No. 138½ Washington Street, up stairs, (opposite School Street,) Boston. HORACE MANN, Editor. Price, One Dollar a year, payable in advance.]